

When the divisor of a rational expression is a linear factor in the form $\frac{bx+c}{}$, you can use a process called synthetic division

Compare the methods of the rational expression below to find the quotient.

$ \begin{array}{r} \boxed{x+3} \\ x+2 \overline{) x^2 + 5x + 6} \\ \underline{(-) x^2 + 2x} \\ 3x + 6 \\ \underline{(-) 3x + 6} \\ 0 \end{array} $	$ \frac{x^2 + 5x + 6}{x + 2} $ $ \downarrow $ $ \begin{array}{l} x+2=0 \\ -2-2 \\ x=-2 \end{array} $	<p style="text-align: center;">Synthetic Division</p> $ \begin{array}{r rrr} -2 & 1 & 5 & 6 \\ (+) & \downarrow & -2 & -6 \\ \hline & 1 & 3 & 0 \end{array} $ <p style="text-align: center;"> $x + 3$ 0 remainder </p>
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To perform synthetic division, the divisor **must be** a linear term in the form $x - c$.

Let's Practice!

1. Find the quotient of the rational expression below.

$$\frac{-24a + 4a^3 + 12 + 8a^2}{-4 + 4a} \div 4$$

$$\frac{a^3 + 2a^2 - 6a + 3}{a - 1}$$

$$\begin{array}{r|rrrr} 1 & 1 & 2 & -6 & 3 \\ (+) & \downarrow & 1 & 3 & -3 \\ \hline & 1 & 3 & -3 & 0 \\ & a^2 & +3a & -3 & \end{array}$$

2. Find the quotient of the rational expression below.

$$\frac{9y^3 + 9y^2 - y + 2}{y + \frac{2}{3}}$$

$$\begin{array}{r|rrrr} -\frac{2}{3} & 9 & 9 & -1 & 2 \\ & & -6 & -2 & 2 \\ \hline & 9 & 3 & -3 & 4-R \end{array}$$

$$9y^2 + 3y - 3 + \frac{4}{y + \frac{2}{3}}$$

Try It!

3. Find the quotient of the rational expression below.

$$\frac{3u^3 + 11u^2 - 6u - 18}{u + 4}$$

$$\begin{array}{r|rrrr} -4 & 3 & 11 & -6 & -18 \\ & & -12 & 4 & 8 \\ \hline & 3 & -1 & -2 & -10 \end{array}$$

$$3u^2 - u - 2 - \frac{10}{u+4}$$

Try It!

4. Find the quotient of the rational expression below.

$$\frac{3x^3 + 2x^2 - 4x + 1}{x - \frac{1}{3}}$$

$$\begin{array}{r|rrrr} \frac{1}{3} & 3 & 2 & -4 & 1 \\ & & 1 & 1 & -1 \\ \hline & 3 & 3 & -3 & 0 \end{array}$$

$3x^2 + 3x - 3$

BEAT THE TEST!

1. Select all the expressions for $d(x)$ that satisfy the parameters for synthetic division.

$$\frac{2x^4 - 9x^3 - 4x^2 + 5x - 13}{d(x)}$$

$d(x) =$

- $-9 + x$
- $3x^{-1} + 4$
- $x - 13$
- $x - \frac{1}{2}$
- $7x^2 - x$
- $5x - 7 - 4x$ x^{-7}
- 6

Assignment: Practice workbook

Sections 1: Topics 1-4

"Check your Understanding for Topic 1:
Section 4" (Online)

- Check your understanding is under
classlink, algebra nation.